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(71)Applicant : MATSUSHITA ELECTRIC IND CO LTD

(72)Inventor : HADO KAZUHITO
YASUMOTO EIICHI
NISHIDA KAZUFUMI
GYOTEN HISAAKI
KANBARA TERUHISA

(54) METHOD FOR ACTIVATING HIGH MOLECULAR ELECTROLYTE FUEL CELL

(57)Abstract:

PROBLEM TO BE SOLVED: To instantaneously provide the battery output of high performance when operating a high molecular electrolyte fuel cell, immediately after assembling it or operating the fuel cell again after it has been left standing unused for a long time.

SOLUTION: A high molecular electrolyte fuel cell is boiled in the deionized water, or the hot water is led into a gas supplying passage, or alcohol is led into the gas supplying passage of the high molecular electrolyte fuel cell, and thereafter the fuel cell is washed by the deionized water. Power is generated at a high oxygen utilizing factor in the high molecular electrolyte fuel cell, and held at a low electric potential so as to easily lead out the battery output of high performance natural to the battery itself in a short time.

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CLAIMS

[Claim(s)]
[Claim 1] The activation approach of the polyelectrolyte mold fuel cell characterized by boiling said polyelectrolyte mold fuel cell module by deionized water or weak acidic underwater one in the polyelectrolyte mold fuel cell module which used as the unit cell what pinched the polyelectrolyte film with the positive electrode and the negative electrode, and pinched said positive electrode and said negative electrode further with the bipolar plate which has a gas supply way, and carried out the laminating of said unit cell, a collecting electrode plate, an electric insulating plate, and the end plate at least.
[Claim 2] What pinched the polyelectrolyte film with the positive electrode and the negative electrode, and pinched said positive electrode and said negative electrode further with the bipolar plate which has a gas supply way is used as a unit cell. At least Said unit cell, In the polyelectrolyte mold fuel cell module which carried out the laminating of a collecting electrode plate, an electric insulating plate, and the end plate The activation approach of the polyelectrolyte mold fuel cell characterized by introducing hot deionized water or weak acidic water into said gas supply way from the operating temperature of said polyelectrolyte mold fuel cell.
[Claim 3] The activation approach of the polyelectrolyte mold fuel cell according to claim 2 characterized by making into two or more 0.1 kgf/cm the pressure of the deionized water or weak acidic water introduced into a gas supply way.
[Claim 4] What pinched the polyelectrolyte film with the positive electrode and the negative electrode, and pinched said positive electrode and said negative electrode further with the bipolar plate which has a gas supply way is used as a unit cell. At least Said unit cell, In the polyelectrolyte mold fuel cell module which carried out the laminating of a collecting electrode plate, an electric insulating plate, and the end plate The activation approach of the polyelectrolyte mold fuel cell characterized by washing said gas supply way with a steam, deionized water, or weak acidic water after introducing alcohol into said gas supply way.
[Claim 5] The activation approach of a polyelectrolyte mold fuel cell according to claim 1, 2, 3, or 4 that weak acidic water is characterized by being hydrogen peroxide solution.
[Claim 6] The ion exchange group of the polyelectrolyte film is the activation approach of the polyelectrolyte mold fuel cell according to claim 1, 2, 3, or 4 characterized by being SO3H and weak acidic water being the water solution of a dilute sulfuric acid.
[Claim 7] What pinched the polyelectrolyte film with the positive electrode and the negative electrode, and pinched said positive electrode and said negative electrode with the bipolar plate further is used as a unit cell. At least Said unit cell, In the polyelectrolyte mold fuel cell module which carried out the laminating of a collecting electrode plate, an electric insulating plate, and the end plate Said polyelectrolyte mold fuel cell module is generated with 50% or more of oxygen utilization factor. Furthermore, the activation approach of the polyelectrolyte mold fuel cell characterized by impressing the electrical potential difference from which the average electrical potential difference per said unit cell becomes less than [0.3V] to predetermined time and said polyelectrolyte mold fuel cell module.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the activation approach of a polyelectrolyte mold fuel cell.
[0002]
[Description of the Prior Art] Carbon, or a metal bipolar plate and a metal cooling plate constituted the conventional polyelectrolyte mold fuel cell in the polyelectrolyte thin film of proton conductivity, a positive electrode and the electrode of a negative electrode, the gasket located in each electrode periphery section, and the pan. The mixture which the electrode catalyst bed which contributes to a cell reaction made the component mixture of an ingredient equivalent to the carbon powder and electrolyte which supported the precious metal catalyst, and added the repellent of a fluorocarbon compound system etc. as occasion demands to this is a general component. An electrode joins and constitutes said electrode catalyst bed and gaseous diffusion layer. Thus, the constituted electrode constitutes a cell combining the poly membrane which is an electrolyte. The component of an anode and a cathode can use the same thing, when using pure hydrogen as a fuel. the hydrogen which reformed the hydrocarbon system fuel -- when using rich gas as a fuel, in order to control poisoning of the precious metal catalyst by the carbon monoxide contained in reformed gas, adding and constituting CO-proof poisoning ingredients, such as a ruthenium, only in an anode side has also been considered. Moreover, since it is eased so that temperature is high, when using reformed gas for a fuel, the 70 to about 90 degrees C thing for which a cell is comparatively operated at an elevated temperature is common [CO poisoning property of an electrode].
[0003] On the other hand, -CF2- is used as a principal chain, generally what carried out the pendant of the side chain which makes a sulfone radical (-SO3H) an end functional group is used for this, and a polyelectrolyte functions as an electrolyte of the proton conductivity in the condition that moisture was included. Therefore, in the operating state of a cell, although an electrolyte needs to be in the condition which always contained moisture, the electrolyte in the condition that moisture was included presents strong acid nature. Therefore, acid resistance is required of the ingredient of the part which touches an electrolyte directly.
[0004] Where moisture is included, in order for an electrolyte to function as an electrolyte, to operate a polyelectrolyte mold fuel cell, it is necessary to supply to a cell the fuel and air which were humidified till the dew-point of temperature comparable as a cell operating temperature. Humidification control of distributed gas becomes important, so that especially a cell operating temperature becomes an elevated temperature.
[0005]
[Problem(s) to be Solved by the Invention] When assembling a polyelectrolyte mold fuel cell and making it operate immediately after, or when re-operating the cell left with long duration un-using it, even if it supplies what held the cell to predetermined temperature and controlled distributed gas in predetermined temperature and the predetermined amount of humidification, generally it is difficult to

obtain the cell output of high performance in an instant. Since the electrode diffusion layer of a polyelectrolyte mold fuel cell is given a water-repellent finish, this cause depends it on requiring long duration for carrying out hydration of the virgin electrode diffusion layer which has not got wet at all.
[0006] Moreover, it is because long duration is also taken for an ingredient equivalent to the polyelectrolyte contained in an electrode catalyst to fully absorb moisture. And a cell is held to predetermined temperature, and even if it supplies what controlled distributed gas in predetermined temperature and the predetermined amount of humidification and carries out long duration maintenance, with unloaded condition, an electrode diffusion layer is not hydrated simply. Furthermore, an ingredient equivalent to the polyelectrolyte contained in an electrode catalyst cannot absorb moisture easily, a generation of electrical energy is continued with high current density, and it becomes possible to pull out the cell output of the high performance which the cell originally has several days after at last.
[0007] Therefore, in order to pull out the high performance output of a cell at an early stage conventionally, it generates electricity with high current density more in pure oxygen, or where the distributed gas of a large flow rate is fully supplied, potential regulation was performed, and activation of maintaining cell voltage to the 0V neighborhood has been performed. It was common to have required several hours or more for pulling out the cell output of the high performance which the cell originally has also by such technique.
[0008]
[Means for Solving the Problem] In order to solve the above technical problem, the activation approach of the polyelectrolyte mold fuel cell of this invention What pinched the polyelectrolyte film with the positive electrode and the negative electrode, and pinched said positive electrode and said negative electrode further with the bipolar plate which has a gas supply way is used as a unit cell. At least Said unit cell, In the polyelectrolyte mold fuel cell module which carried out the laminating of a collecting electrode plate, an electric insulating plate, and the end plate, it is characterized by boiling said polyelectrolyte mold fuel cell module by deionized water or weak acidic underwater one.
[0009] Moreover, in the polyelectrolyte mold fuel cell module which used as the unit cell what pinched the polyelectrolyte film with the positive electrode and the negative electrode, and pinched said positive electrode and said negative electrode further with the bipolar plate which has a gas supply way, and carried out the laminating of said unit cell, a collecting electrode plate, an electric insulating plate, and the end plate at least, it is characterized by introducing hot deionized water or weak acidic water into said gas supply way from the operating temperature of said polyelectrolyte mold fuel cell.
[0010] At this time, it is effective to make into two or more 0.1 kgf/cm the pressure of the deionized water or weak acidic water introduced into a gas supply way.
[0011] What pinched the polyelectrolyte film with the positive electrode and the negative electrode, and pinched said positive electrode and said negative electrode further with the bipolar plate which has a gas supply way is used as a unit cell. At least Moreover, said unit cell, In the polyelectrolyte mold fuel cell module which carried out the laminating of a collecting electrode plate, an electric insulating plate, and the end plate, after introducing alcohol into said gas supply way, it is characterized by washing said gas supply way with a steam, deionized water, or weak acidic water.
[0012] It is effective that weak acidic water is hydrogen peroxide solution above. Furthermore, it is effective that the ion exchange group of the polyelectrolyte film is SO3H, and weak acidic water is the water solution of a dilute sulfuric acid.
[0013] What pinched the polyelectrolyte film with the positive electrode and the negative electrode, and pinched said positive electrode and said negative electrode with the bipolar plate further is used as a unit cell. At least Moreover, said unit cell, In the polyelectrolyte mold fuel cell module which carried out the laminating of a collecting electrode plate, an electric insulating plate, and the end plate Said polyelectrolyte mold fuel cell module is generated with 50% or more of oxygen utilization factor, and it is characterized by impressing further the electrical potential difference from which the average electrical potential difference per said unit cell becomes less than [0.3V] to predetermined time and said polyelectrolyte mold fuel cell module.
[0014]

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[Embodiment of the Invention] This invention makes it possible to pull out simply the cell output of the high performance which the cell originally has for a short time by boiling a polyelectrolyte mold fuel cell by deionized water or weak acidic underwater one. At this time, by boiling by weak acidic underwater one, the impurity ion contained in an ingredient equivalent to the polyelectrolyte contained in an electrolyte membrane or an electrode catalyst bed is exchanged for a proton, and it becomes possible to pull out high performance more.

[0015] However, it is assumed that it is difficult in the capacity of a container or the viewpoint of handling nature to boil the fuel cell stack of a large area or a high laminating underwater. Then, it becomes simply possible by introducing hot deionized water or weak acidic water into the gas supply way of a polyelectrolyte mold fuel cell from a predetermined cell operating temperature to pull out the cell output of the high performance which the cell originally has for a short time. It becomes possible by pressurizing water pressure at two or more 0.1 kgf/cm at this time to pull out the cell output of high performance early more still more preferably.

[0016] Moreover, as for the diffusion layer of an electrode, it is possible by introducing alcohol into the gas supply way of a polyelectrolyte mold fuel cell to make it get used with alcohol immediately. Then, by washing with a steam, deionized water, or weak acidic water, simply, hydration of the electrode diffusion layer is carried out for a short time, and it becomes possible to pull out the cell output of the high performance which the cell originally has.

[0017] If residual alcohol exists in a fuel electrode side at this time, according to an electrode catalyst, alcohol will oxidize and the electrode poisoning matter will be generated. In order to pull out the cell output of the high performance which the cell originally has, it is more important than a fuel electrode side to carry out hydration of the electrode diffusion layer by the side of a positive electrode. Then, sufficient effectiveness is acquired even if it supplies alcohol only to an air side. Moreover, after supplying a oxidizing gas also to a fuel electrode side after activation for the time being and carrying out oxidation clearance of the electrode poisoning matter further, it is more desirable to supply fuel gas.

[0018] Moreover, when what carried out the pendant of the side chain which uses for example, -CF2- as a principal chain, and makes a sulfone radical (-SO3H) an end functional group as a polyelectrolyte at this is used, in order to activate this, the water solution of a dilute sulfuric acid is desirable as weak acidic water. Since the ion exchange group of a polyelectrolyte is -SO3H, even if the reason introduces a dilute sulfuric acid into this, it is because sulfate ion does not remain.

[0019] Moreover, it is necessary to remove a metal ion in the deionized water or weak acidic water introduced at an activation process. If this reason has a metal ion, -SO3- will combine with a metal ion, will be set to -SO3Me (Me is a metallic element), and will depend it on the thing which is the ion exchange group of a polyelectrolyte and for which ion-exchange capacity is lost, for example. In order to prevent this phenomenon, as weak acidic water to introduce, especially the hydrogen peroxide solution that consists of only purity and a hydrogen ion is useful.

[0020] Furthermore, a polyelectrolyte mold fuel cell is generated with 50% or more of ratio of oxygen utilization, the positive-electrode side of a cell is changed into a half-asphyxiation condition, and the steam generated from the cell by holding average cell voltage with the potential not more than 0.3V enables it simply to pull out the cell output of the high performance which the cell originally has for a short time.

[0021]

[Example] Hereafter, the example of this invention is explained.

[0022] (Example 1) To acetylene black system carbon powder, it is mean particle diameter 30 [about]. What supported the platinum particle 25% of the weight was made into the catalyst of a reaction electrode. The dispersion solution which distributed the powder of the perfluorocarbon sulfonic acid which showed this catalyst powder to the solution which isopropanol was made to distribute by (** 1) in ethyl alcohol was mixed, and it was made the shape of a paste. This paste was used as the raw material, it was with screen printing, and the electrode catalyst bed was formed in one field of a carbon nonwoven fabric with a thickness of 250 micrometers. The amount of platinum contained in the reaction electrode after formation adjusted the amount of 0.5 mg/cm2 and perfluorocarbon sulfonic acid so that

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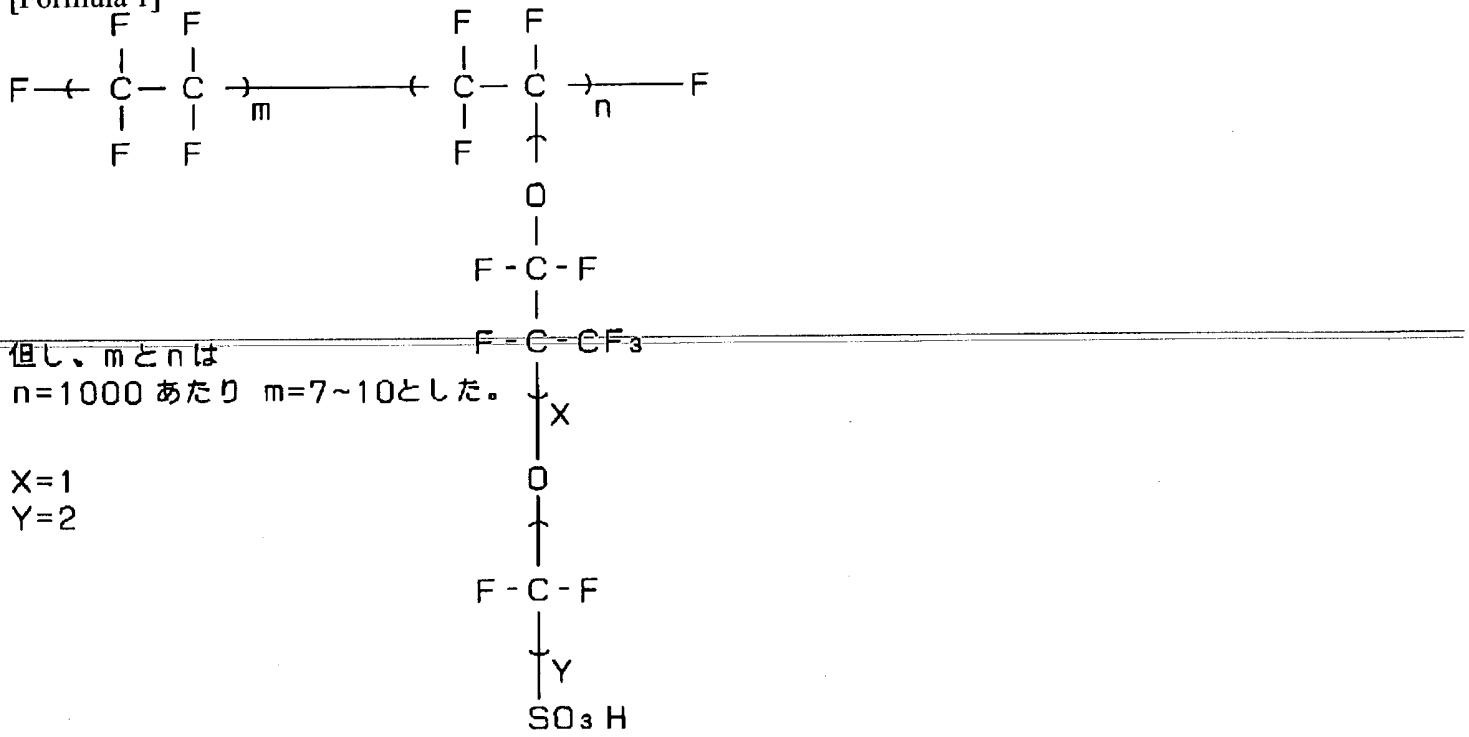
1.2mg /might be set to 2 cm.
[0023]
[Formula 1]



[0024] These electrodes considered the positive electrode and the negative electrode as the same configuration, to both sides of the core of the proton conductivity polyelectrolyte film which has a somewhat larger area than an electrode, it joined with the hotpress so that the printed catalyst bed might touch an electrolyte membrane side, and they created the electrode / electrolyte zygote (MEA) in them. Here, what thin-film-ized the perfluorocarbon sulfonic acid shown in (** 2) in thickness of 25 micrometers as a proton conductivity polyelectrolyte was used.
[0025]
[Formula 2]

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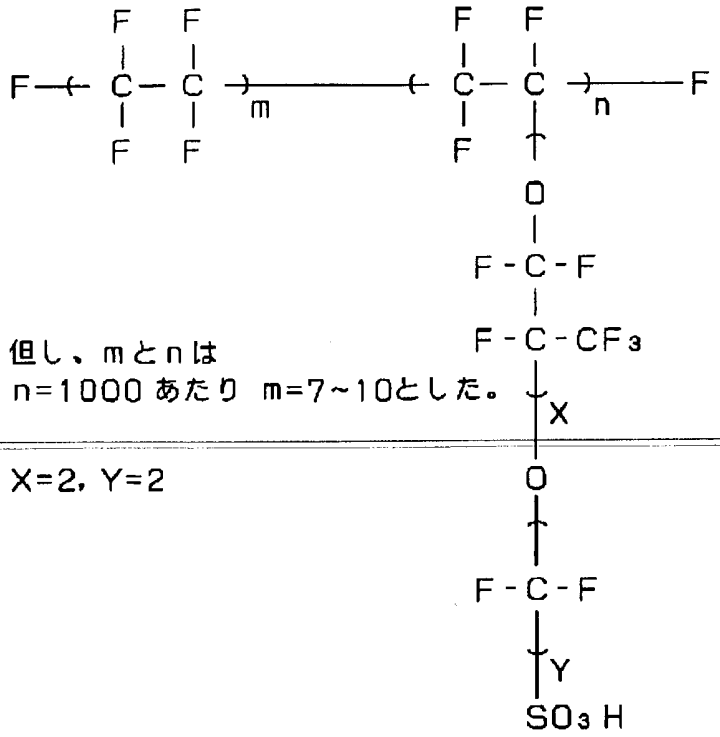

但し、mとnは
n=1000 あたり m=7~10とした。

X=2, Y=2

[0026] Said MEA sandwiched MEA between two bipolar plates, and constituted the polyelectrolyte mold fuel cell from a form which faces the gas passageway of two bipolar plates which consist of nonvesicular carbon. Between both the end plates of installation and the maximum outside was bound tight for the heater plate, the collecting electrode plate, the electric insulating plate, and the end plate which prepared the respectively required hole for gas manifolds in both the outsides of this polyelectrolyte mold fuel cell by the pressure of 20kg/cm2 to the electrode surface product using the bolt, the spring, and the nut, and the cell of a polyelectrolyte mold fuel cell was constituted. This cell was boiled for 1 hour in distilled water which performed the ion exchange.
[0027] Then, this polyelectrolyte mold fuel cell was held at 75 degrees C, and the air which humidified and warmed the hydrogen gas humidified and warmed so that a 73-degree C dew-point might come at one electrode side so that a 68-degree C dew-point might come at another electrode side was supplied. At this time, the cell voltage of 0.98V was obtained at the time of no-load. Moreover, when the continuation generation-of-electrical-energy trial was performed for this cell on condition that 80% of fuel utilization rates, 40% of ratios of oxygen utilization, and current density 0.3 A/cm2, the cell voltage beyond 0.7V was obtained from immediately after the generation of electrical energy. Furthermore, it was able to generate electricity without degradation of cell voltage, maintaining the cell voltage beyond 0.7V over 5000 hours or more.
[0028] It did not boil in distilled water which carried out the ion exchange with the configuration completely same for a comparison, i.e., the polyelectrolyte mold fuel cell without activation was created, and the generation-of-electrical-energy trial was performed on these conditions. Consequently, only the cell voltage of 0.93V was obtained at the time of no-load. Moreover, in early stages, this cell could not be operated on condition that 80% of fuel utilization rates, 40% of ratios of oxygen utilization, and current density 0.3 A/cm2, and when the load was taken compulsorily, the electromotive voltage fell to less than [0V]. Then, the generation-of-electrical-energy trial was performed on condition that 70% of fuel utilization rates, 20% of ratios of oxygen utilization, and current density 0.1 A/cm2, it checked that the engine performance had improved gradually, and the load was gradually increased to 0.7 A/cm2. It was required for about three days to repeat said actuation 3 times, return the blasting-fumes utilization factor etc. to the original conditions, and obtain the cell voltage beyond 0.7V by the load of 0.3 A/cm2.
[0029] Although this example showed the example which boiled the cell in distilled water which

performed the ion exchange, the effectiveness that the same was said of what was saved for 2 hours in the hydrogen peroxide solution set to ph=5 was shown.
[0030] (Example 2) To acetylene black system carbon powder, it is mean particle diameter 30 [about]. What supported the platinum particle 25% of the weight was made into the catalyst of a reaction electrode. The dispersion solution which distributed the powder of the perfluorocarbon sulfonic acid which showed this catalyst powder to the solution which isopropanol was made to distribute by (** 1) in ethyl alcohol was mixed, and it was made the shape of a paste. This paste was used as the raw material, it was with screen printing, and the electrode catalyst bed was formed in one field of a carbon nonwoven fabric with a thickness of 250 micrometers. The amount of platinum contained in the reaction electrode after formation adjusted the amount of 0.5 mg/cm2 and perfluorocarbon sulfonic acid so that 1.2mg /might be set to 2 cm.
[0031] These electrodes considered the positive electrode and the negative electrode as the same configuration, to both sides of the core of the proton conductivity polyelectrolyte film which has a somewhat larger area than an electrode, it joined with the hotpress so that the printed catalyst bed might touch an electrolyte membrane side, and they created the electrode / electrolyte zygote (MEA) in them. Here, what thin-film-ized the perfluorocarbon sulfonic acid shown in (** 2) in thickness of 25 micrometers as a proton conductivity polyelectrolyte was used.
[0032] Said MEA sandwiched MEA between two bipolar plates, and constituted the polyelectrolyte mold fuel cell from a form which faces the gas passageway of two bipolar plates which consist of nonvesicular carbon. Between both the end plates of installation and the maximum outside was bound tight for the heater plate, the collecting electrode plate, the electric insulating plate, and the end plate which prepared the respectively required hole for gas manifolds in both the outsides of this polyelectrolyte mold fuel cell by the pressure of 20kg/cm2 to the electrode surface product using the bolt, the spring, and the nut, and the cell of a polyelectrolyte mold fuel cell was constituted.
[0033] It carried out the 100-step laminating continuously, having used this as the unit cell. Between both the end plates of installation and the maximum outside was bound tight for the collecting electrode plate, the electric insulating plate, and the end plate which established respectively required the gas manifold and the hole for cooling water manifolds in both the outsides of this layer built cell by the pressure of 20kg/cm2 to the electrode surface product using the bolt, the spring, and the nut, and the polyelectrolyte mold fuel cell stack was constituted.
[0034] The 95-degree C sulfuric-acid water solution [0.01-N] was introduced for 30 minutes from the positive-electrode side and the negative-electrode side ring main inlet of this cell. At this time, it adjusted so that the pressure of 0.1 kgf/cm2 might be applied to the water solution which extracted and introduced the exhaust port of an outlet side.
[0035] Then, this polyelectrolyte mold fuel cell stack was held at 75 degrees C by circulating through cooling water, and when the air which humidified and warmed the hydrogen gas humidified and warmed so that a 68-degree C dew-point might come at another electrode side was supplied so that a 73-degree C dew-point might come at one electrode side, the cell voltage of 0.98V was obtained at the time of no-load. Moreover, when the continuation generation-of-electrical-energy trial was performed for this cell on condition that 80% of fuel utilization rates, 40% of ratios of oxygen utilization, and current density 0.3 A/cm2, the cell voltage beyond 0.7V was obtained from immediately after the generation of electrical energy. Furthermore, it was able to generate electricity without degradation of cell voltage, maintaining the cell voltage beyond 0.7V over 5000 hours or more.
[0036] Although this example showed the example which activated the 95-degree C sulfuric-acid water solution [0.01-N] by introducing for 30 minutes from the positive-electrode side and the negative-electrode side ring main inlet of a cell, effectiveness with the same said of what activated the hydrogen peroxide solution set to ph=5 at 90 degrees C by introducing for 1 hour was shown. Moreover, what introduced 95-degree C deionized water for 3 hours acquired the same effectiveness similarly.
[0037] (Example 3) To acetylene black system carbon powder, it is mean particle diameter 30 [about]. What supported the platinum particle 25% of the weight was made into the catalyst of a reaction electrode. The dispersion solution which distributed the powder of the perfluorocarbon sulfonic acid

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which showed this catalyst powder to the solution which isopropanol was made to distribute by (** 1) in ethyl alcohol was mixed, and it was made the shape of a paste. This paste was used as the raw material, it was with screen printing, and the electrode catalyst bed was formed in one field of a carbon nonwoven fabric with a thickness of 250 micrometers. The amount of platinum contained in the reaction electrode after formation adjusted the amount of 0.5 mg/cm2 and perfluorocarbon sulfonic acid so that 1.2mg /might be set to 2 cm.

[0038] These electrodes considered the positive electrode and the negative electrode as the same configuration, to both sides of the core of the proton conductivity polyelectrolyte film which has a somewhat larger area than an electrode, it joined with the hotpress so that the printed catalyst bed might touch an electrolyte membrane side, and they created the electrode / electrolyte zygote (MEA) in them. Here, what thin-film-ized the perfluorocarbon sulfonic acid shown in (** 2) in thickness of 25 micrometers as a proton conductivity polyelectrolyte was used.

[0039] Said MEA sandwiched MEA between two bipolar plates, and constituted the polyelectrolyte mold fuel cell from a form which faces the gas passageway of two bipolar plates which consist of nonvesicular carbon. Between both the end plates of installation and the maximum outside was bound tight for the heater plate, the collecting electrode plate, the electric insulating plate, and the end plate which prepared the respectively required hole for gas manifolds in both the outsides of this polyelectrolyte mold fuel cell by the pressure of 20kg/cm2 to the electrode surface product using the bolt, the spring, and the nut, and the cell of a polyelectrolyte mold fuel cell was constituted.

[0040] From gas supply opening of this cell, after supplying about 100 cc methanol, ion-exchange distilled water was supplied and washed. Then, this polyelectrolyte mold fuel cell was held at 75 degrees C, and after supplying the air humidified and warmed for 1 hour so that a 70-degree C dew-point may come at electrode [both] side, nitrogen gas permuted the fuel electrode side. Then, when the air which humidified and warmed the hydrogen gas humidified and warmed so that a 68-degree C dew-point might come at an air pole side was supplied so that a 73-degree C dew-point might come at a fuel electrode side, the cell voltage of 0.98V was obtained at the time of no-load. Moreover, when the continuation generation-of-electrical-energy trial was performed for this cell on condition that 80% of fuel utilization rates, 40% of ratios of oxygen utilization, and current density 0.3 A/cm2, the cell voltage beyond 0.7V was obtained from immediately after the generation of electrical energy. Furthermore, it was able to generate electricity without degradation of cell voltage, maintaining the cell voltage beyond 0.7V over 5000 hours or more.

[0041] Although it was activated by supplying ion-exchange distilled water in this example after supplying a methanol, effectiveness with the same said of what activated the hydrogen peroxide solution set to ph=5 by introducing for 1 hour was shown.

[0042] Moreover, the same effectiveness was acquired even if it used the water solution of the dilute sulfuric acid set to ph=5.

(Example 4) To acetylene black system carbon powder, it is mean particle diameter 30 [about]. What supported the platinum particle 25% of the weight was made into the catalyst of a reaction electrode. The dispersion solution which distributed the powder of the perfluorocarbon sulfonic acid which showed this catalyst powder to the solution which isopropanol was made to distribute by (** 1) in ethyl alcohol was mixed, and it was made the shape of a paste. This paste was used as the raw material, it was with screen printing, and the electrode catalyst bed was formed in one field of a carbon nonwoven fabric with a thickness of 250 micrometers. The amount of platinum contained in the reaction electrode after formation adjusted the amount of 0.5 mg/cm2 and perfluorocarbon sulfonic acid so that 1.2mg /might be set to 2 cm.

[0043] These electrodes considered the positive electrode and the negative electrode as the same configuration, to both sides of the core of the proton conductivity polyelectrolyte film which has a somewhat larger area than an electrode, it joined with the hotpress so that the printed catalyst bed might touch an electrolyte membrane side, and they created the electrode / electrolyte zygote (MEA) in them. Here, what thin-film-ized the perfluorocarbon sulfonic acid shown in (** 2) in thickness of 25 micrometers as a proton conductivity polyelectrolyte was used.

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[0044] Said MEA was inserted with the gasket of two sheets, MEA and a gasket were pinched between two bipolar plates, and the polyelectrolyte mold fuel cell consisted of forms where the gas passageway of two bipolar plates which consist of nonvesicular carbon plates further faced each other. Between both the end plates of installation and the maximum outside was bound tight for the heater plate, the collecting electrode plate, the electric insulating plate, and the end plate which prepared the respectively required hole for gas manifolds in both the outsides of this polyelectrolyte mold fuel cell by the pressure of 20kg/cm2 to the electrode surface product using the bolt, the spring, and the nut, and the cell of a polyelectrolyte mold fuel cell was constituted.
[0045] Activation was not performed to this cell, but temperature up was carried out to 75 degrees C as it was, and when the air which humidified and warmed the hydrogen gas humidified and warmed so that a 68-degree C dew-point might come at an air pole side was supplied so that a 73-degree C dew-point might come at a fuel electrode side, the cell voltage of 0.93V was obtained at the time of no-load. Next, adjusting a quantity of gas flow so that it may become 90% of fuel utilization rates, and 60% of ratios of oxygen utilization about this cell, it generated electricity by low voltage and held for 1 hour so that cell voltage might be set to 0.1.
[0046] Then, when the quantity of gas flow was adjusted so that it might become 90% of fuel utilization rates, and 60% of ratios of oxygen utilization, and the continuation generation-of-electrical-energy trial was performed by the constant current consistency of 0.3 A/cm2, the cell voltage beyond 0.7V was obtained from immediately after the generation of electrical energy. Furthermore, it was able to generate electricity without degradation of cell voltage, maintaining the cell voltage beyond 0.7V over 5000 hours or more.
[0047] Although activated applied voltage was set to 0.1V per cell in this example, effectiveness fell remarkably on the electrical potential difference higher than 0.3V.
[0048] Moreover, when applied voltage was made lower than 0V per cell and the seal of approval of this was carried out for a long time, the output characteristics of a cell deteriorated. The so-called polarity inversion phenomenon of a cell will happen, and this will be considered to be because for a part of cell reaction part to have been destroyed, if applied voltage is made lower than 0V per cell.
[0049]
[Effect of the Invention] This invention becomes possible [pulling out simply the cell output of the high performance which the cell originally has for a short time] as mentioned above by boiling a polyelectrolyte mold fuel cell by deionized water or weak acidic underwater ones. Moreover, it becomes possible by introducing hot deionized water or weak acidic water into the gas supply way of a polyelectrolyte mold fuel cell from a predetermined cell operating temperature to pull out simply the cell output of the high performance which the cell originally has for a short time. It becomes possible by pressurizing water pressure at two or more 0.1 kgf/cm at this time to pull out the cell output of high performance early more still more preferably.
[0050] Moreover, after introducing alcohol into the gas supply way of a polyelectrolyte mold fuel cell, it becomes possible by washing with a steam, deionized water, or weak acidic water to pull out simply the cell output of the high performance which the cell originally has for a short time.
[0051] Moreover, a polyelectrolyte mold fuel cell is generated with 50% or more of ratio of oxygen utilization, and it becomes possible by holding average cell voltage 10 seconds or more with the potential not more than 0.3V to pull out simply the cell output of the high performance which the cell originally has for a short time.

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TECHNICAL FIELD

[Field of the Invention] This invention relates to the activation approach of a polyelectrolyte mold fuel cell.

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PRIOR ART

[Description of the Prior Art] Carbon, or a metal bipolar plate and a metal cooling plate constituted the conventional polyelectrolyte mold fuel cell in the polyelectrolyte thin film of proton conductivity, a positive electrode and the electrode of a negative electrode, the gasket located in each electrode periphery section, and the pan. The mixture which the electrode catalyst bed which contributes to a cell reaction made the component mixture of an ingredient equivalent to the carbon powder and electrolyte which supported the precious metal catalyst, and added the repellent of a fluorocarbon compound system etc. as occasion demands to this is a general component. An electrode joins and constitutes said electrode catalyst bed and gaseous diffusion layer. Thus, the constituted electrode constitutes a cell combining the poly membrane which is an electrolyte. The component of an anode and a cathode can use the same thing, when using pure hydrogen as a fuel. the hydrogen which reformed the hydrocarbon system fuel -- when using rich gas as a fuel, in order to control poisoning of the precious metal catalyst by the carbon monoxide contained in reformed gas, adding and constituting CO-proof poisoning ingredients, such as a ruthenium, only in an anode side has also been considered. Moreover, since it is eased so that temperature is high, when using reformed gas for a fuel, the 70 to about 90 degrees C thing for which a cell is comparatively operated at an elevated temperature is common [CO poisoning property of an electrode].
[0003] On the other hand, -CF2- is used as a principal chain, generally what carried out the pendant of the side chain which makes a sulfone radical (-SO3H) an end functional group is used for this, and a polyelectrolyte functions as an electrolyte of the proton conductivity in the condition that moisture was included. Therefore, in the operating state of a cell, although an electrolyte needs to be in the condition which always contained moisture, the electrolyte in the condition that moisture was included presents strong acid nature. Therefore, acid resistance is required of the ingredient of the part which touches an electrolyte directly.
[0004] Where moisture is included, in order for an electrolyte to function as an electrolyte, to operate a polyelectrolyte mold fuel cell, it is necessary to supply to a cell the fuel and air which were humidified till the dew-point of temperature comparable as a cell operating temperature. Humidification control of distributed gas becomes important, so that especially a cell operating temperature becomes an elevated temperature.

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EFFECT OF THE INVENTION

[Effect of the Invention] This invention becomes possible [pulling out simply the cell output of the high performance which the cell originally has for a short time] as mentioned above by boiling a polyelectrolyte mold fuel cell by deionized water or weak acidic underwater one. Moreover, it becomes possible by introducing hot deionized water or weak acidic water into the gas supply way of a polyelectrolyte mold fuel cell from a predetermined cell operating temperature to pull out simply the cell output of the high performance which the cell originally has for a short time. It becomes possible by pressurizing water pressure at two or more 0.1 kgf/cm at this time to pull out the cell output of high performance early more still more preferably.
[0050] Moreover, after introducing alcohol into the gas supply way of a polyelectrolyte mold fuel cell, it becomes possible by washing with a steam, deionized water, or weak acidic water to pull out simply the cell output of the high performance which the cell originally has for a short time.
[0051] Moreover, a polyelectrolyte mold fuel cell is generated with 50% or more of ratio of oxygen utilization, and it becomes possible by holding average cell voltage 10 seconds or more with the potential not more than 0.3V to pull out simply the cell output of the high performance which the cell originally has for a short time.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] When assembling a polyelectrolyte mold fuel cell and making it operate immediately after, or when re-operating the cell left with long duration un-using it, even if it supplies what held the cell to predetermined temperature and controlled distributed gas in predetermined temperature and the predetermined amount of humidification, generally it is difficult to obtain the cell output of high performance in an instant. Since the electrode diffusion layer of a polyelectrolyte mold fuel cell is given a water-repellent finish, this cause depends it on requiring long duration for carrying out hydration of the virgin electrode diffusion layer which has not got wet at all.
[0006] Moreover, it is because long duration is also taken for an ingredient equivalent to the polyelectrolyte contained in an electrode catalyst to fully absorb moisture. And a cell is held to predetermined temperature, and even if it supplies what controlled distributed gas in predetermined temperature and the predetermined amount of humidification and carries out long duration maintenance, with unloaded condition, an electrode diffusion layer is not hydrated simply. Furthermore, an ingredient equivalent to the polyelectrolyte contained in an electrode catalyst cannot absorb moisture easily, a generation of electrical energy is continued with high current density, and it becomes possible to pull out the cell output of the high performance which the cell originally has several days after at last.
[0007] Therefore, in order to pull out the high performance output of a cell at an early stage conventionally, it generates electricity with high current density more in pure oxygen, or where the distributed gas of a large flow rate is fully supplied, potential regulation was performed, and activation of maintaining cell voltage to the 0V neighborhood has been performed. It was common to have required several hours or more for pulling out the cell output of the high performance which the cell originally has also by such technique.

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MEANS

[Means for Solving the Problem] In order to solve the above technical problem, the activation approach of the polyelectrolyte mold fuel cell of this invention What pinched the polyelectrolyte film with the positive electrode and the negative electrode, and pinched said positive electrode and said negative electrode further with the bipolar plate which has a gas supply way is used as a unit cell. At least Said unit cell, In the polyelectrolyte mold fuel cell module which carried out the laminating of a collecting electrode plate, an electric insulating plate, and the end plate, it is characterized by boiling said polyelectrolyte mold fuel cell module by deionized water or weak acidic underwater one.
[0009] Moreover, in the polyelectrolyte mold fuel cell module which used as the unit cell what pinched the polyelectrolyte film with the positive electrode and the negative electrode, and pinched said positive electrode and said negative electrode further with the bipolar plate which has a gas supply way, and carried out the laminating of said unit cell, a collecting electrode plate, an electric insulating plate, and the end plate at least, it is characterized by introducing hot deionized water or weak acidic water into said gas supply way from the operating temperature of said polyelectrolyte mold fuel cell.
[0010] At this time, it is effective to make into two or more 0.1 kgf/cm the pressure of the deionized water or weak acidic water introduced into a gas supply way.
[0011] What pinched the polyelectrolyte film with the positive electrode and the negative electrode, and pinched said positive electrode and said negative electrode further with the bipolar plate which has a gas supply way is used as a unit cell. At least Moreover, said unit cell, In the polyelectrolyte mold fuel cell module which carried out the laminating of a collecting electrode plate, an electric insulating plate, and the end plate, after introducing alcohol into said gas supply way, it is characterized by washing said gas supply way with a steam, deionized water, or weak acidic water.
[0012] It is effective that weak acidic water is hydrogen peroxide solution above. Furthermore, it is effective that the ion exchange group of the polyelectrolyte film is SO3H, and weak acidic water is the water solution of a dilute sulfuric acid.
[0013] What pinched the polyelectrolyte film with the positive electrode and the negative electrode, and pinched said positive electrode and said negative electrode with the bipolar plate further is used as a unit cell. At least Moreover, said unit cell, In the polyelectrolyte mold fuel cell module which carried out the laminating of a collecting electrode plate, an electric insulating plate, and the end plate Said polyelectrolyte mold fuel cell module is generated with 50% or more of oxygen utilization factor, and it is characterized by impressing further the electrical potential difference from which the average electrical potential difference per said unit cell becomes less than [0.3V] to predetermined time and said polyelectrolyte mold fuel cell module.
[0014]
[Embodiment of the Invention] This invention makes it possible to pull out simply the cell output of the high performance which the cell originally has for a short time by boiling a polyelectrolyte mold fuel cell by deionized water or weak acidic underwater one. At this time, by boiling by weak acidic underwater one, the impurity ion contained in an ingredient equivalent to the polyelectrolyte contained in an electrolyte membrane or an electrode catalyst bed is exchanged for a proton, and it becomes

possible to pull out high performance more.
[0015] However, it is assumed that it is difficult in the capacity of a container or the viewpoint of handling nature to boil the fuel cell stack of a large area or a high laminating underwater. Then, it becomes simply possible by introducing hot deionized water or weak acidic water into the gas supply way of a polyelectrolyte mold fuel cell from a predetermined cell operating temperature to pull out the cell output of the high performance which the cell originally has for a short time. It becomes possible by pressurizing water pressure at two or more 0.1 kgf/cm at this time to pull out the cell output of high performance early more still more preferably.
[0016] Moreover, as for the diffusion layer of an electrode, it is possible by introducing alcohol into the gas supply way of a polyelectrolyte mold fuel cell to make it get used with alcohol immediately. Then, by washing with a steam, deionized water, or weak acidic water, simply, hydration of the electrode diffusion layer is carried out for a short time, and it becomes possible to pull out the cell output of the high performance which the cell originally has.
[0017] If residual alcohol exists in a fuel electrode side at this time, according to an electrode catalyst, alcohol will oxidize and the electrode poisoning matter will be generated. In order to pull out the cell output of the high performance which the cell originally has, it is more important than a fuel electrode side to carry out hydration of the electrode diffusion layer by the side of a positive electrode. Then, sufficient effectiveness is acquired even if it supplies alcohol only to an air side. Moreover, after supplying a oxidizing gas also to a fuel electrode side after activation for the time being and carrying out oxidation clearance of the electrode poisoning matter further, it is more desirable to supply fuel gas.
[0018] Moreover, when what carried out the pendant of the side chain which uses for example, -CF2- as a principal chain, and makes a sulfone radical (-SO3H) an end functional group as a polyelectrolyte at this is used, in order to activate this, the water solution of a dilute sulfuric acid is desirable as weak acidic water. Since the ion exchange group of a polyelectrolyte is -SO3H, even if the reason introduces a dilute sulfuric acid into this, it is because sulfate ion does not remain.
[0019] Moreover, it is necessary to remove a metal ion in the deionized water or weak acidic water introduced at an activation process. If this reason has a metal ion, -SO3- will combine with a metal ion, will be set to -SO3Me (Me is a metallic element), and will depend it on the thing which is the ion exchange group of a polyelectrolyte and for which ion-exchange capacity is lost, for example. In order to prevent this phenomenon, as weak acidic water to introduce, especially the hydrogen peroxide solution that consists of only purity and a hydrogen ion is useful.
[0020] Furthermore, a polyelectrolyte mold fuel cell is generated with 50% or more of ratio of oxygen utilization, the positive-electrode side of a cell is changed into a half-asphyxiation condition, and the steam generated from the cell by holding average cell voltage with the potential not more than 0.3V enables it simply to pull out the cell output of the high performance which the cell originally has for a short time.

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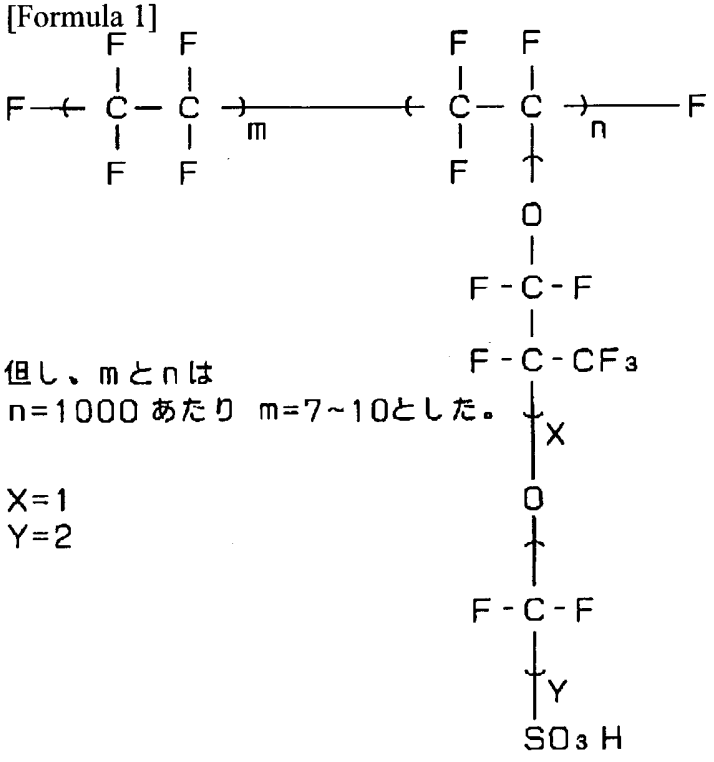
EXAMPLE

[Example] Hereafter, the example of this invention is explained.
[0022] (Example 1) To acetylene black system carbon powder, it is mean particle diameter 30 [about]. What supported the platinum particle 25% of the weight was made into the catalyst of a reaction electrode. The dispersion solution which distributed the powder of the perfluorocarbon sulfonic acid which showed this catalyst powder to the solution which isopropanol was made to distribute by (** 1) in ethyl alcohol was mixed, and it was made the shape of a paste. This paste was used as the raw material, it was with screen printing, and the electrode catalyst bed was formed in one field of a carbon nonwoven fabric with a thickness of 250 micrometers. The amount of platinum contained in the reaction electrode after formation adjusted the amount of 0.5 mg/cm2 and perfluorocarbon sulfonic acid so that 1.2mg /might be set to 2 cm.
[0023]
[Formula 1]



但し、mとnは
n=1000 あたり m=7~10とした。

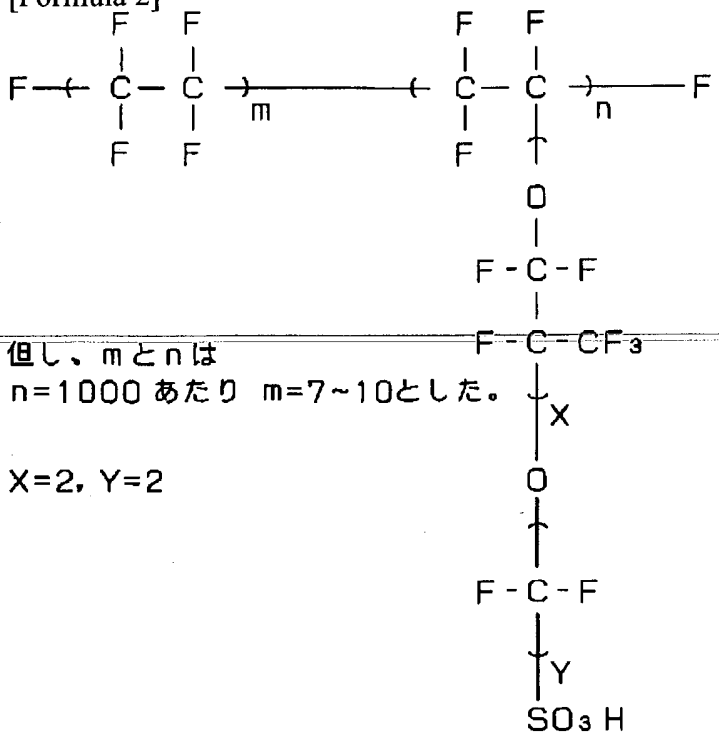
X=1
Y=2

[0024] These electrodes considered the positive electrode and the negative electrode as the same configuration, to both sides of the core of the proton conductivity polyelectrolyte film which has a somewhat larger area than an electrode, it joined with the hotpress so that the printed catalyst bed might touch an electrolyte membrane side, and they created the electrode / electrolyte zygote (MEA) in them. Here, what thin-film-ized the perfluorocarbon sulfonic acid shown in (** 2) in thickness of 25

micrometers as a proton conductivity polyelectrolyte was used.

[0025]

[Formula 2]



但し、mとnは
n=1000 あたり m=7~10とした。

X=2, Y=2

[0026] Said MEA sandwiched MEA between two bipolar plates, and constituted the polyelectrolyte mold fuel cell from a form which faces the gas passageway of two bipolar plates which consist of nonvesicular carbon. Between both the end plates of installation and the maximum outside was bound tight for the heater plate, the collecting electrode plate, the electric insulating plate, and the end plate which prepared the respectively required hole for gas manifolds in both the outsides of this polyelectrolyte mold fuel cell by the pressure of 20kg/cm2 to the electrode surface product using the bolt, the spring, and the nut, and the cell of a polyelectrolyte mold fuel cell was constituted. This cell was boiled for 1 hour in distilled water which performed the ion exchange.

[0027] Then, this polyelectrolyte mold fuel cell was held at 75 degrees C, and the air which humidified and warmed the hydrogen gas humidified and warmed so that a 73-degree C dew-point might come at one electrode side so that a 68-degree C dew-point might come at another electrode side was supplied. At this time, the cell voltage of 0.98V was obtained at the time of no-load. Moreover, when the continuation generation-of-electrical-energy trial was performed for this cell on condition that 80% of fuel utilization rates, 40% of ratios of oxygen utilization, and current density 0.3 A/cm2, the cell voltage beyond 0.7V was obtained from immediately after the generation of electrical energy. Furthermore, it was able to generate electricity without degradation of cell voltage, maintaining the cell voltage beyond 0.7V over 5000 hours or more.

[0028] It did not boil in distilled water which carried out the ion exchange with the configuration completely same for a comparison, i.e., the polyelectrolyte mold fuel cell without activation was created, and the generation-of-electrical-energy trial was performed on these conditions. Consequently, only the cell voltage of 0.93V was obtained at the time of no-load. Moreover, in early stages, this cell could not be operated on condition that 80% of fuel utilization rates, 40% of ratios of oxygen utilization, and current density 0.3 A/cm2, and when the load was taken compulsorily, the electromotive voltage fell to less than [0V]. Then, the generation-of-electrical-energy trial was performed on condition that 70% of fuel utilization rates, 20% of ratios of oxygen utilization, and current density 0.1 A/cm2, it checked that the engine performance had improved gradually, and the load was gradually increased to 0.7 A/cm2. It

was required for about three days to repeat said actuation 3 times, return the blasting-fumes utilization factor etc. to the original conditions, and obtain the cell voltage beyond 0.7V by the load of 0.3 A/cm2.
[0029] Although this example showed the example which boiled the cell in distilled water which performed the ion exchange, the effectiveness that the same was said of what was saved for 2 hours in the hydrogen peroxide solution set to ph=5 was shown.
[0030] (Example 2) To acetylene black system carbon powder, it is mean particle diameter 30 [about]. What supported the platinum particle 25% of the weight was made into the catalyst of a reaction electrode. The dispersion solution which distributed the powder of the perfluorocarbon sulfonic acid which showed this catalyst powder to the solution which isopropanol was made to distribute by (** 1) in ethyl alcohol was mixed, and it was made the shape of a paste. This paste was used as the raw material, it was with screen printing, and the electrode catalyst bed was formed in one field of a carbon nonwoven fabric with a thickness of 250 micrometers. The amount of platinum contained in the reaction electrode after formation adjusted the amount of 0.5 mg/cm2 and perfluorocarbon sulfonic acid so that 1.2mg /might be set to 2 cm.
[0031] These electrodes considered the positive electrode and the negative electrode as the same configuration, to both sides of the core of the proton conductivity polyelectrolyte film which has a somewhat larger area than an electrode, it joined with the hotpress so that the printed catalyst bed might touch an electrolyte membrane side, and they created the electrode / electrolyte zygote (MEA) in them. Here, what thin-film-ized the perfluorocarbon sulfonic acid shown in (** 2) in thickness of 25 micrometers as a proton conductivity polyelectrolyte was used.
[0032] Said MEA sandwiched MEA between two bipolar plates, and constituted the polyelectrolyte mold fuel cell from a form which faces the gas passageway of two bipolar plates which consist of nonvesicular carbon. Between both the end plates of installation and the maximum outside was bound tight for the heater plate, the collecting electrode plate, the electric insulating plate, and the end plate which prepared the respectively required hole for gas manifolds in both the outsides of this polyelectrolyte mold fuel cell by the pressure of 20kg/cm2 to the electrode surface product using the bolt, the spring, and the nut, and the cell of a polyelectrolyte mold fuel cell was constituted.
[0033] It carried out the 100-step laminating continuously, having used this as the unit cell. Between both the end plates of installation and the maximum outside was bound tight for the collecting electrode plate, the electric insulating plate, and the end plate which established respectively required the gas manifold and the hole for cooling water manifolds in both the outsides of this layer built cell by the pressure of 20kg/cm2 to the electrode surface product using the bolt, the spring, and the nut, and the polyelectrolyte mold fuel cell stack was constituted.
[0034] The 95-degree C sulfuric-acid water solution [0.01-N] was introduced for 30 minutes from the positive-electrode side and the negative-electrode side ring main inlet of this cell. At this time, it adjusted so that the pressure of 0.1 kgf/cm2 might be applied to the water solution which extracted and introduced the exhaust port of an outlet side.
[0035] Then, this polyelectrolyte mold fuel cell stack was held at 75 degrees C by circulating through cooling water, and when the air which humidified and warmed the hydrogen gas humidified and warmed so that a 68-degree C dew-point might come at another electrode side was supplied so that a 73-degree C dew-point might come at one electrode side, the cell voltage of 0.98V was obtained at the time of no-load. Moreover, when the continuation generation-of-electrical-energy trial was performed for this cell on condition that 80% of fuel utilization rates, 40% of ratios of oxygen utilization, and current density 0.3 A/cm2, the cell voltage beyond 0.7V was obtained from immediately after the generation of electrical energy. Furthermore, it was able to generate electricity without degradation of cell voltage, maintaining the cell voltage beyond 0.7V over 5000 hours or more.
[0036] Although this example showed the example which activated the 95-degree C sulfuric-acid water solution [0.01-N] by introducing for 30 minutes from the positive-electrode side and the negative-electrode side ring main inlet of a cell, effectiveness with the same said of what activated the hydrogen peroxide solution set to ph=5 at 90 degrees C by introducing for 1 hour was shown. Moreover, what introduced 95-degree C deionized water for 3 hours acquired the same effectiveness similarly.

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[0037] (Example 3) To acetylene black system carbon powder, it is mean particle diameter 30 [about]. What supported the platinum particle 25% of the weight was made into the catalyst of a reaction electrode. The dispersion solution which distributed the powder of the perfluorocarbon sulfonic acid which showed this catalyst powder to the solution which isopropanol was made to distribute by (** 1) in ethyl alcohol was mixed, and it was made the shape of a paste. This paste was used as the raw material, it was with screen printing, and the electrode catalyst bed was formed in one field of a carbon nonwoven fabric with a thickness of 250 micrometers. The amount of platinum contained in the reaction electrode after formation adjusted the amount of 0.5 mg/cm2 and perfluorocarbon sulfonic acid so that 1.2mg /might be set to 2 cm.

[0038] These electrodes considered the positive electrode and the negative electrode as the same configuration, to both sides of the core of the proton conductivity polyelectrolyte film which has a somewhat larger area than an electrode, it joined with the hotpress so that the printed catalyst bed might touch an electrolyte membrane side, and they created the electrode / electrolyte zygote (MEA) in them. Here, what thin-film-ized the perfluorocarbon sulfonic acid shown in (** 2) in thickness of 25 micrometers as a proton conductivity polyelectrolyte was used.

[0039] Said MEA sandwiched MEA between two bipolar plates, and constituted the polyelectrolyte mold fuel cell from a form which faces the gas passageway of two bipolar plates which consist of nonvesicular carbon. Between both the end plates of installation and the maximum outside was bound tight for the heater plate, the collecting electrode plate, the electric insulating plate, and the end plate which prepared the respectively required hole for gas manifolds in both the outsides of this polyelectrolyte mold fuel cell by the pressure of 20kg/cm2 to the electrode surface product using the bolt, the spring, and the nut, and the cell of a polyelectrolyte mold fuel cell was constituted.

[0040] From gas supply opening of this cell, after supplying about 100 cc methanol, ion-exchange distilled water was supplied and washed. Then, this polyelectrolyte mold fuel cell was held at 75 degrees C, and after supplying the air humidified and warmed for 1 hour so that a 70-degree C dew-point may come at electrode [both] side, nitrogen gas permuted the fuel electrode side. Then, when the air which humidified and warmed the hydrogen gas humidified and warmed so that a 68-degree C dew-point might come at an air pole side was supplied so that a 73-degree C dew-point might come at a fuel electrode side, the cell voltage of 0.98V was obtained at the time of no-load. Moreover, when the continuation generation-of-electrical-energy trial was performed for this cell on condition that 80% of fuel utilization rates, 40% of ratios of oxygen utilization, and current density 0.3 A/cm2, the cell voltage beyond 0.7V was obtained from immediately after the generation of electrical energy. Furthermore, it was able to generate electricity without degradation of cell voltage, maintaining the cell voltage beyond 0.7V over 5000 hours or more.

[0041] Although it was activated by supplying ion-exchange distilled water in this example after supplying a methanol, effectiveness with the same said of what activated the hydrogen peroxide solution set to ph=5 by introducing for 1 hour was shown.

[0042] Moreover, the same effectiveness was acquired even if it used the water solution of the dilute sulfuric acid set to ph=5.

(Example 4) To acetylene black system carbon powder, it is mean particle diameter 30 [about]. What supported the platinum particle 25% of the weight was made into the catalyst of a reaction electrode. The dispersion solution which distributed the powder of the perfluorocarbon sulfonic acid which showed this catalyst powder to the solution which isopropanol was made to distribute by (** 1) in ethyl alcohol was mixed, and it was made the shape of a paste. This paste was used as the raw material, it was with screen printing, and the electrode catalyst bed was formed in one field of a carbon nonwoven fabric with a thickness of 250 micrometers. The amount of platinum contained in the reaction electrode after formation adjusted the amount of 0.5 mg/cm2 and perfluorocarbon sulfonic acid so that 1.2mg /might be set to 2 cm.

[0043] These electrodes considered the positive electrode and the negative electrode as the same configuration, to both sides of the core of the proton conductivity polyelectrolyte film which has a somewhat larger area than an electrode, it joined with the hotpress so that the printed catalyst bed might

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touch an electrolyte membrane side, and they created the electrode / electrolyte zygote (MEA) in them. Here, what thin-film-ized the perfluorocarbon sulfonic acid shown in (** 2) in thickness of 25 micrometers as a proton conductivity polyelectrolyte was used.

[0044] Said MEA was inserted with the gasket of two sheets, MEA and a gasket were pinched between two bipolar plates, and the polyelectrolyte mold fuel cell consisted of forms where the gas passageway of two bipolar plates which consist of nonvesicular carbon plates further faced each other. Between both the end plates of installation and the maximum outside was bound tight for the heater plate, the collecting electrode plate, the electric insulating plate, and the end plate which prepared the respectively required hole for gas manifolds in both the outsides of this polyelectrolyte mold fuel cell by the pressure of 20kg/cm2 to the electrode surface product using the bolt, the spring, and the nut, and the cell of a polyelectrolyte mold fuel cell was constituted.

[0045] Activation was not performed to this cell, but temperature up was carried out to 75 degrees C as it was, and when the air which humidified and warmed the hydrogen gas humidified and warmed so that a 68-degree C dew-point might come at an air pole side was supplied so that a 73-degree C dew-point might come at a fuel electrode side, the cell voltage of 0.93V was obtained at the time of no-load. Next, adjusting a quantity of gas flow so that it may become 90% of fuel utilization rates, and 60% of ratios of oxygen utilization about this cell, it generated electricity by low voltage and held for 1 hour so that cell voltage might be set to 0.1.

[0046] Then, when the quantity of gas flow was adjusted so that it might become 90% of fuel utilization rates, and 60% of ratios of oxygen utilization, and the continuation generation-of-electrical-energy trial was performed by the constant current consistency of 0.3 A/cm2, the cell voltage beyond 0.7V was obtained from immediately after the generation of electrical energy. Furthermore, it was able to generate electricity without degradation of cell voltage, maintaining the cell voltage beyond 0.7V over 5000 hours or more.

[0047] Although activated applied voltage was set to 0.1V per cell in this example, effectiveness fell remarkably on the electrical potential difference higher than 0.3V.

[0048] Moreover, when applied voltage was made lower than 0V per cell and the seal of approval of this was carried out for a long time, the output characteristics of a cell deteriorated. The so-called polarity inversion phenomenon of a cell will happen, and this will be considered to be because for a part of cell reaction part to have been destroyed, if applied voltage is made lower than 0V per cell.

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